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Evaluation of Sediment From Chinook Channel in Baker Bay

Abstract

Sediment samples (6) taken from shoals in Chinook Channel were analyzed for both chemical and physical analysis. Physical analysis indicated the material is primarily silty sand progressing to silt as the sampling approaches the marina. Chemical analysis include metals, polynuclear aromatic hydrocarbons (PAHs), total organic carbon (TOC), acid volatile sulfide (AVS), pesticides/polychlorobiphenyls (PCBs). All chemical and physical analysis for this material indicate that the material is suitable for either unconfined in-water or upland disposal with no adverse environmental impact expected.

Introduction

1. Chinook Channel is located in Baker Bay near Columbia River mile 5.0. The channel begins near the head of Sand Island and proceeds northeast for about 2 miles to the Chinook boat basin. The channel is 150 feet wide and 10 feet deep leading to the turning basin at Chinook. The turning basin, which is maintained by local interests, is 10 feet deep, 590 feet long and 500 feet wide. Chinook Channel is subject to heavy shoaling, especially between channel mile (CM) 0.7 and 1.5 and in that part of the channel extending into the mooring basin at Chinook. A clamshell dredge (1) has been used to dredge the channel with material usually being disposed at Area D, an in-water site located at Columbia River mile 6.5. Siltier material from the upper end of the channel has been disposed of on East Sand Island at two beach nourishment sites and one diked upland site.

2. Past Chinook Channel sampling of the federal projects took place in 1980, 86, 87, and 92 (2-10). In the 1980 study, three sediment samples were taken from shoals along the length of the channel. A sediment evaluation report was prepared detailing the results of physical and chemical tests (6). Physical tests showed that the material progressed from silty sand at the beginning of the channel to sandy silt near the boat basin. The organic content of the samples increased as the silt content increased. Chemical tests for contaminants in the bulk indicated that metals, pesticides and PCBs were below established guidelines. Elutriate tests, which predict the concentrations that could enter the water column during disposal, revealed that ammonia, cadmium and manganese release exceeded guidelines. However, it was predicted that precipitation and dilution from mixing, during in-water disposal, would bring the levels of these chemicals to below guidelines. Results from the 1986, 1987 and 1992 tests followed the same basic pattern as those from 1980 and corroborated them. In these studies, elutriate tests showed that concentrations of cadmium and manganese were not above concern levels as in previous tests. PAHs and phenols were added to the list of contaminants looked for in those later studies. In 1992 EPA funded additional analysis of samples taken within the marina. As expected these samples contained finer grained materials and higher levels of enrichment. The chemical results, with few exceptions show the sediment is relatively uncontaminated when compared to EPA, Region 10 screening levels for marine waters.

Over the years, more than 80 contaminants have been tested for in Chinook Channel sediment and elutriate samples.

3. Chinook Channel sediment, as noted, is high in silts and organic material, especially near the mooring basin. Due to the percent fines and the length of time since last sampled, both physical and chemical analysis were run on the sediment to update our knowledge of its condition and suitability for unconfined in-water or upland disposal, in compliance with the Clean Water Act.

Methods

4. On June 9, 1997 six samples, C-VV-1 through C-VV-6, were taken from the Chinook Channel at locations indicated on site map (Figure 1). The samples were taken by U.S. Army Corps of Engineers (USACE) and National Marine Fisheries Service (NMFS) personnel, using a Van Veen box sampler. Sample aliquots were taken in plastic zip lock bags for physical analysis and pre-cleaned, EPA approved, glass jars for chemical analysis. Samples were held at 4°C ±2°C, as required by EPA for environmental samples, prior to shipping to the laboratory. Physical samples were analyzed by U.S. Army Corps of Engineers Materials Lab, Troutdale, Oregon for grain size distribution and volatile solids content. Chemical samples were shipped to Columbia Analytical Services, Inc. (CAS), Kelso, Washington for heavy metals analysis, total organic carbon (TOC), polynuclear aromatic hydrocarbon (PAH), pesticides/polychlorobiphenyls (PCBs) and acid volatile sulfides (AVS). Pour water tributyltin (TBT) was requested for one sample (C-VV-6), but was not run due to insufficient sample volume available. All samples and analysis were performed according to EPA/USACE approved methods (11). Quality control (QC) standards were run by CAS laboratory.

Results/Discussion

5. The results of physical analysis are shown in Table 1. Samples collected are considered representative of the material to be dredged.

6. The concentrations of inorganics are shown in Table 2. The concentration of metals are below established concern levels (12). Samples C-VV-4 through 6 had up to nearly 20 times the acid volatile Sulfides (AVS) than samples C-VV-1 through 3. AVS can help bind heavy metals and reduce their toxicity. Examination of Table 2 reveals a consistent pattern of greater concentrations of metals in samples C-VV-4 through 6 vs. C-VV-1 through 3. Samples C-VV-4 through 6 were located in an area that contained more fine grain material and organic content than the other samples, which lead to their differences. All inorganics were below screening limits.

7. The results of organic analysis are shown in Table 3 & Table 4. All concentrations of organics were below established concern levels.

8. The results of physical and chemical analyses of the sediment confirm earlier studies and indicate that Chinook channel sediment has not degraded significantly over the years. This and previous sediment quality evaluations have concluded that no unacceptable, adverse environmental impacts would be expected from its disposal. In the past, sediment from this part of the channel has been disposed upland and at Area D. Physical impacts from disposal would be minimal because of the high energy, dispersive nature of this in-water disposal site. The impact to benthics at the in-water site would be minimal since most of the finer grained material would be rapidly dispersed. It is probable that the populations of benthics at this high energy site are adapted to rapidly changing conditions, A temporary, local increase in turbidity would be expected at both the in-water and upland sites. If placed upland, returning water from the diked upland site should meet water quality criteria.

Recommendations

9. According to provisions of the Clean Water Act (CWA) the sediment from Chinook Channel is acceptable for both unconfined in-water and diked upland disposal. Because of the high silt content use as beach nourishment material is not recommended. Results from this and earlier studies show that no unacceptable adverse environmental impacts would be expected from its disposal.

References

1. Navigation Branch, Operations Division, U. S. Army Corps of Engineers, Portland District. September 1991. Federal Navigation Projects: Columbia River Maintenance Disposal Plan. (Prepared by Mandaville Associates, 600 S. W. Tenth #418, Portland, Oregon 92205)

2. U. S. Army Corps of Engineers, Portland District. July-August 1980. Findings of Compliance Dredged Material Disposal Operations Baker Bay Navigation Project.

3. U. S. Army Corps of Engineers, Portland District. June 1981. Factual determinations Columbia River at Baker Bay Proposed Channel Improvement.

4. U. S. Army Corps of Engineers, Portland District. July 1983. (Data taken from Corps sediment quality database showing samples taken in 1983).

5. Turner, R. and Babcock, S. U. S. Army Corps of Engineers, Portland District. December 1988. Results of 1987 Baker Bay at Ilwaco, WA Sediment Quality Testing.

6. U. S. Army Corps of Engineers, Portland District. July-August 1980. Findings of Compliance Dredged Material Disposal Operations Chinook Federal Navigation Project.

7. U. S. Army Corps of Engineers, Portland District. December 1986, July 1987. (Data taken from Corps sediment quality database showing results of physical and chemical analyses of sediment samples taken in 1986-87 from Chinook Channel).

8. Briton J. U. S. Army Corps of Engineers, Portland District. July 1992. Evaluation of Sediment at U. S. Coast Guard Station Ilwaco, Washington.

9. Briton J. U. S. Army Corps of Engineers, Portland District. August 1992. Baker Bay West Channel Sediment Evaluation.

10. Briton J. U. S. Army Corps of Engineers, Portland District. October 1992. Evaluation of sediment from Chinook Channel in Baker Bay.

11. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1991. Evaluation of Dredge Material proposed for Ocean Disposal (Testing Manuel).

12. U. S. Army Corps of Engineers, Portland District. November 1991. Levels of Concern Tier II Analysis. (A list of chemicals and associated concern levels in bulk sediment, established as a temporary guideline useful in evaluating toxicity of sediment. These levels of concern are subject to change as new information warrants.)

Table 1

Chinook Channel Sediment - Physical Analysis

	mm	%			
sample	median grain size	sand	silt	clay	volitle solids
C-VV-1	0.12000	65.2	26.5	8.3	1.9
C-VV-2	0.05400	45.2	44.6	10.2	3.4
C-VV-3	0.08000	60.1	29.0	10.9	2.6
C-VV-4	0.00097	5.5	67.2	27.3	2.6
C-VV-5	0.00730	1.5	65.1	33.4	7.3
C-VV-6	0.00760	1.8	68.0	30.2	7.8

Table 2

Chinook Channel Sediment - Inorganic and Total Organic Carbon (TOC) Analysis

	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	AVS	TOC
					ppm					ppm	%
C-VV-1	3	<0.8	13	15	7	<0.05	12	<0.6	57	1.6	0.8
C-VV-2	4	<0.8	18	27	9	0.05	17	<0.6	83	12.0	1.0
C-VV-3	3	<0.8	17	22	10	<0.05	16	<0.6	73	11.0	1.1
C-VV-4	7	<0.8	24	50	17	0.09	21	<0.6	115	160.0	2.3
C-VV-5	7	<0.8	25	55	16	0.08	22	<0.6	125	230.0	2.3
C-VV-6	8	<0.8	30	60	19	0.08	27	<0.6	131	150.0	2.4

Table 3

Chinook Channel Sediment - Organic Analysis

	PCB - 7 arochlor analytes (ppb)	Pesticides - *19organochlorine analytes (ppb)				
		Aldrin	Dieldrin	4,4'-DDE	4,4'-DDD	4,4'-DDT
C-VV-1	ND	<0.2	<0.4	0.5	0.3	<0.2
C-VV-2	ND	0.3	<0.4	0.8	0.4	0.3
C-VV-3	ND	<0.2	<0.4	0.7	0.3	0.2
C-VV-4	ND	<0.2	<0.4	1.0	0.7	<0.2
C-VV-5	ND	0.2	1.0	1.0	0.9	0.6
C-VV-6	ND	<0.2	<0.4	0.9	0.4	<0.2

ND = none detected

* table shows only analytes where detection was noted

Table 4a

Chinook Channel Sediment - Organic Analysis (cont'd)
Polynuclear Aromatic Hydrocarbons (PAH) - 8 (low density) analytes

	Acenaphthene	Acenaphthylene	Anthracene	Dibenzofuran	Fluorene
C-VV-1	1	1	2	1	2
C-VV-2	5	7	3	1	6
C-VV-3	0.6	2	2	0.8	1
C-VV-4	13	18	18	3	19
C-VV-5	1	2	3	1	2
C-VV-6	1	1	4	1	2

	2-Methylnapthalene	Naphthalene	Phenanthrene	**Total Low PAHs**
C-VV-1	3	4	8	22
C-VV-2	3	9	10	46
C-VV-3	3	3	8	20
C-VV-4	6	18	54	149
C-VV-5	5	4	1	19
C-VV-6	4	3	16	32

Table 4b

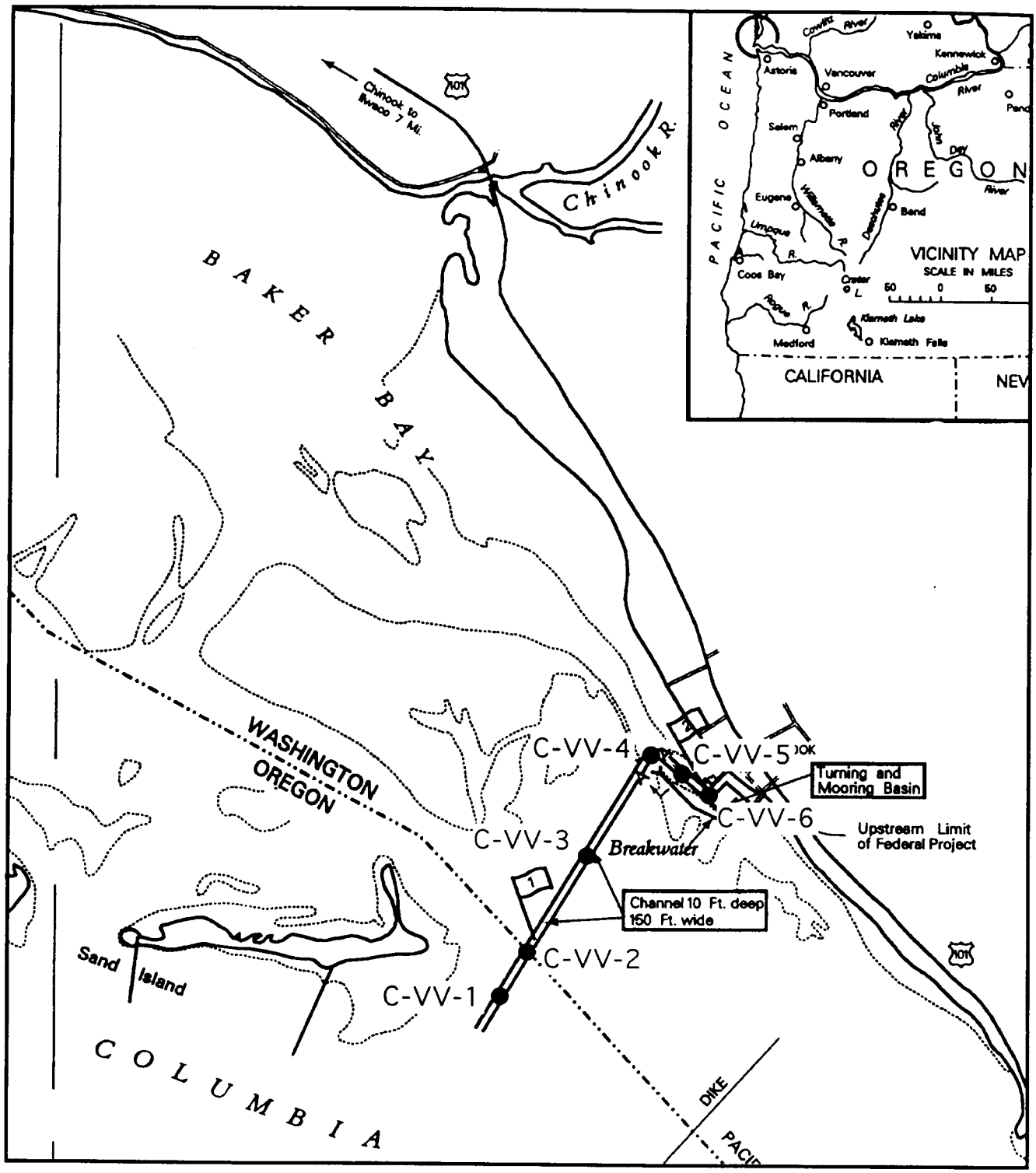
Chinook Channel Sediment - Organic Analysis (cont'd)
Polynuclear Aromatic Hydrocarbons (PAHs) - 10 (high density) analytes

	Benz(a)anthracene	Benzo(b)fluroanthene	Benzo(k)fluroanthene	Benzo(g,h,I)perylene	Benzo(a)pyrene
C-VV-1	5	7	6	6	7
C-VV-2	8	10	7	11	12
C-VV-3	6	8	6	6	9
C-VV-4	32	30	31	28	43
C-VV-5	12	16	14	14	18
C-VV-6	12	17	16	12	17

	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Pyrene
C-VV-1	8	1	14	7	14
C-VV-2	11	2	17	12	22
C-VV-3	9	2	16	8	17
C-VV-4	40	7	71	36	78
C-VV-5	17	3	21	17	27
C-VV-6	21	3	38	15	42

	Total High PAHs
C-VV-1	75
C-VV-2	112
C-VV-3	87
C-VV-4	396
C-VV-5	159
C-VV-6	193

Figure 1



Chinook Channel Sediment Sample Locations June 1997